

expanded to determine the expression of hundreds or thousands of genes simultaneously (e.g. by DNA arrays). We can create hypotheses which state that expression of a single specific gene can be used to determine the potential of a culture, or hypotheses that state that the expression of a group of genes (e.g., hypothetical genes A, B, C, D, E, F) acts as an indicator of high embryogenic potential. For example, all these genes may be expressed at a high level in cell lines that produce large numbers of embryos, thus we would select cell lines which exhibited this characteristic. Alternatively specific levels of expression for genes A, B, C, D, E and F may be required and a combination of high and low expression of particular genes will identify desirable cultures. Alternatively, experience will determine that certain exceptions can be tolerated.

[0182] While the previous paragraphs discuss numbers of embryos produced, the principle applies to ANY desired characteristic: by establishing a correlation of gene expression with e.g., germination potential, embryo size, growth of plantlets in their first year, disease resistance of mature plants, environmental hardiness or wood quality. Any trait where could be evaluated by these gene expression assays and correlations with gene expression established, resulting in a molecular tool which could be used to predict desirable characteristics. Explicitly, we could use these gene expression tools to select cell lines which will produce high quality plantlets months before they grow into plantlets, or cell lines or juvenile plantlets which will produce hardy trees with desirable wood quality, years before these traits are expressed.

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TABLE I

cDNA	Embryo Phase	Clone	Nucleotide Sequence
SEQ ID NO:1	Late	LPS-001	GGTACTCCACCGTAATAACCCCTTGGGAAATAGCCTATGATCCAGGGGAGGCAACC ACCTATATCATTGACAACAGCGAAAAATGTGGCGCAAGAAGTTTCACATACAATTCA TGGTTACAAAGATCACATACCAGGTGTTGGAGCAGATTTCGATAGATATTGAAGATAT GAAGCCAAGGAGTGGAGCAGTTATTGAAAAGGGCACAAAAAATTTGCCATTTACA AAGATGAAAATGGGCTGATTCACAAATACTCGGCAATATGCCACACATGAACTGT ATTGTGAAATGGAATCCTATAGACTCAACTTTGATTGCCCTGCCATGGTTCAATG TTTGATAATCTGGGTCGATGCATCAATGGACCTGCCAAGGCGGACCTATTTCCCGA AGATTAACGATAGTTGTTTGTACATGTAATTATCTTGATATTGTATATATATGATTTA AATTATACAGTACAATAAATCCATGTTTGCAGGCTATTTCTGCTTGATAATTTAGCTC CAGATTTATACATAACCAGTTTATTTGGCTGTTTTTCCCTGGCAAAAAAAAAAAAA
SEQ ID NO:2	Late	LPS-003	003GGTACTCCACAGAAAGAAATGATTTGACAGAAAAAGAGAGCTGTAGGATTGGGT AAACCCTGCAGTGGATATATACAATGTATATGTAATCTGTCTGTTTTCTGTTATTTG ACGGAAATAAAACGCCATAGCGACGGATGACTGTAAATCCTTAGGGACGGATGAC TGTAATCCTTAGGTTGGAAGATTACAAACGACATATGGGTCTTTCAATTTTCAGAT TTCTGTAAGACTTACATTTCAAAGACTGTTTGGATGGGCAAAAAAAAAAAAA
SEQ ID NO:3	Middle	LPS-004	GGTACTCCACCAGAATGCCGCAGTTTAGTTCTCTAAAGCAAGCAGTAAATTAATTTT GTCAAAATCTAAAGAGTGTATAGTATCAGTGGGTTTGTATTTCTAGTTTGCCTACA ATAACGATGGGGATTACCCAGTTTTTGTAGAATTTGCAATCATCGGATGACAATTTT AAAGTTTTCTCTAAGTCACCCGCATTGATATCGAGAAGCCTTCCATTTTCAATTATTT AATATCAGAAAATCTTTTCAGTTGGCAAAAAAAAAAAAA
SEQ ID NO:4	Middle	LPS-006	AGCCCAGCTGCGAAGGGGATGTGCTGCAAGCGATAAGTGGTAACGCCAGGTTTCC AGTCAGACGTGTAAACGACGCCAGTGATGTATACGAATCACTATAGGCGATGGCCT TCTAGATGCATGCTCGAGCGCCGAGTGATGAATTGCAGAATCGGCTGGTACT CACGGGCTAGAGAAAGGCACAAGCACTTTTTGTCAATTTAGGATCAGAGGCATTCA GGTATAGGAAGGGTGGCTCAGATAGGCAGATGGATCGGCATTTTGGCCAGTCATG AAACATTTTATGCATGTTATTGCCTCCCAAGGACGAAATCAGTTCTTTGTGCCTTCT GGTGATATCACTTCAAACAAAAGGCAACAGTTCTGTGATTTTCATATGGTTTGTCACT GAATATTTTGTGTCAGATGTTCTCTACTATTTTTATCTGCTTTCAAGTGATTATTTG TTGATTCCCCATGGATAGTTATGCTAATCAGTTGCATTTCTCTTGACCAGTCAACA AACAAAAATGCTTGTAGGAATCCATTACTATTTATTTTCAGACAGGTAAACGTGTAG CTAATTGTTCTGGCAAAAAAAAAAAAA
SEQ ID NO:5	Middle	LPS-007	TCCAAAATACAAAGGCTTTATTTGCATCATGATATAATACAAAGTAAGAAATTTACCC AACTGTTTAACCTAATAATAACAAAGGAAGCATTTTACCCAATCTTTAACGTAAT AATACCAAAGAGTGGAATGCTTTATTGACCAGCAAGACCTTGAAATTTTATAACCA ATGCCCATCAACAGAGCCTTTCTTAAAAAACGCAAGGCCAGCTCTGTACCTTATT AGTTAGTATAAACTGACATTCTTCCAAGCTTGTGTGCGCAGAAACAATAAAGAACTT CACCTTGGTTTAAAGAACGTGCCATGAAGAAAACGTCCAAGAAAAATGAAATGGC TCCTTCGACCATTGATCCTCCCTAGAAAAATCAAAGACTCCTTCGACCATTAGGT CCTCCAATTGGGCATCTAACTACAAGCGGTC
SEQ ID NO:6	Middle	LPS-008	GGTACTCCACGGGCTAGAGAAAAAGGCACAAGCACTTCTTCGTCATTTTAGGGATCA GAGGCATTGAGGTATAGGAAGGGGTGGCTCAGATAGGCAGATGGATCGGCATTTT GCCAGTCATGAAACATTTTATGCATGTTATTGCCTCCCAAGGACGAAATCAGTTCT TTGTGCCTTCTGGTGATATCACTTCAAACAAAAGGCAACAGTTCTGTGATTTTCATAT GGTTTGTCACTGAATATTTTGTGTCAGATGTTCTCTACTATTTTTATCTGCTTTCAA GTGATTATTTGTTGATTCCCATGGATAGTTATGCTAATCAGTTGCATTTCTCTTGTA CCAGTCAACAAACAAAAATGCTTGTAGGAATCCATTACTATTTATTTTCAGACAGGT AAACGTGTAGCTAATTGTTCTGGCAAAAAAAAAAAAA

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cDNA	Embryo Phase	Clone	Nucleotide Sequence
SEQ ID NO:7	Middle	LPS-010	ACGACGTGTAAACGACGGCCAGTGATTGTATACGACTCACTATAGGGCGATTGGC CTTCTAGATGCATGCTCGAGCGGCCGAGGTGATGGATATCTGCAGAATTCGCTT GGTACTCCACGGCTAGAGAAAAGGCACAAGCACTTCTTCGTCATTTTAGGATCAGA GGCATTCAAGGTATAGGAAGGGTGGTCAGATAGGCAGATGGATCGGCATTTTGCCC AGTCATGAAACATTTTATGCATGTTATTGCCTCCCAAGGACGAAATCAGTTCTTTGT GCCTTCTGGTGATATCACTTCAAACAAAAGGCAACAGTTCTGTGATTCATATGGTT TGCACTGAATATTTTGTTCAGATGTTCTCTACTATTTTTATCTGCTTCAAGTGA TTATTTGTTGATTCCCCATGGATAGTTATGCTAATCAGTTGCATTTCTCTGTACCAG TCAACAAACAAAATGCTTGTAGGAATCCATTACTATTTATTTTCAGACAGGTAAAC GTGTAGCTAATTGTTCTGGCAAAAAAAAAAAAA
SEQ ID NO:8	Middle	LPS-011	GGTACTCCACGAAGCAAAAAGAGTCAGGGGAATGAAGATGGGGGGCTCCGACAAG AAGCGGATCAGAGAAGAGCAGGAAATGAGTCCACCTGAGGAATCCTGGAGACAGA AACAGGGGCGTTTAATGGAGTTTGAGGCAGGGATGGCCTATGATAAACCTGAAAAT GCCGGTGCAGGTAATGAGAAATTTGCCAGAGTTTTGCTCTCTTTCAAATGAGTACTC GATGTTATTGAAAGATCCATGGAGTTGGGAGGATAGCACTGGTTTCGGAATCCGAA GCTTAGCTGCTGTGAGGAAGCAGTCTTGATATTGGACTATCTCCATGATTCTGCT GTAGATAATCGCTGTGAAAAGGATTTTGCCGAGCAGCACAAAGGTACAGGAAGAGG AGGATTGTTTGAGAAGGTCTCTTTTTGAAGCCACAGATGATCAGCTCTGGAGGCTT CAGAGTCTTTGCAGGATACAGAAGGTCTGTTTCCTCTGGATTCCGTGGGTAGCCAT GATTGCACGACCTTGTTGCAGGATGAGAGCATTGTTCAAGGCGCTGCTTCTTACTT CAGAATTTGGGAACAGGATGATGGTCACAAGGATGCCAAAATTCATGAAGATGGCA TTGGTTTTGTGTATGGGAGTGGGATCTCGGATTGGATTCCGAGGGCTCCCTCGAA TCAATCTGAGTTTTCTGAATCTGTTGAATTTGAAAGCTCTATGTTTTCACTGTAATTT GGGTCTTTTAATTTCTTCTATGTAATTTGGGTGTTTCTAATTTCTTCTTCAGCAA AAAAAAAAAAAA
SEQ ID NO:9	Middle	LPS-012	GGTACTCCACCATATCCAGGTAAACAAGGGAAAACAGAGTCAGCTTCTAGTATGTT GTATGCCTTGCTCTGTCTGTTTTCTTTGATCTTTGATGCCAAGCAAGTTGAATGTGA TCACTAAATGTTGCTGGCAGTAGAGCTGGAGATGTGCTGTCTCTTTGGTGTCATTA GCACAGAAGCTATTGGAGAAATGATTATTATCTGTTTGATAACTTCTAGAGCATTTT TCTGCTTCCAATTCCACAAGGTGGAAAGTGCAAGGATGTTTACTTTCTTAACTGTA CTTGCCTTGATTTGATGATGTAAGGTTGTGTGGCAAAAAAAAAAAAA
SEQ ID NO:10	Middle	LPS-013	GGTACTCACCATATCCGGTAACAAGGGAACAAGTCAGTTTTAGAAAGTGGACCCCC GGTTCCGTCGTTTTCTTGATCTCGGAGCCAAGCAAGTGGATGTGATCACTAAATGT TGCTGGCAGTAGAGCTGGAGATGTGCTGTCTCTTTGGGTCATTAGCACAGAAGCTA TTGGAGAAATGATTATGGTATTCCACCATATCCAGGTAAACAAGGGAAAACAGAGC TCAGCTTCTAGTATGTTGTATGCCCTGCTCTGTCTGTTTTCTTTGATCTTTGATGCC AAGCAAGTTGAATGTGATCACTAAATGTTGCTGGCAGTAGAGCTGGAGATGTGCTG TCTCTTTGGTGTCATTAGCACAGAAGCTATTGGAGAAATGATTATTATCTGTTTGAT AACTTCTAGAGCATTTTTCTGCTTCCAATTCCACAAGGTGGAAAGTGCAAGGATGTT TACTTTCTTAACTGTACTTGCCTTGATTTGATGATGTAAGGTTGTGTGGCAAAAA AAAAAA
SEQ ID NO:11	Middle	LPS-014	GGTACTCACCATATCCATGTAAACAAGGGAAAACAGAGCTCAGCTTCTAGTATGT AGTATGCCCTGCTCTGTCTGTTTTCTTTGATCTTTGATGCCAAGCAAGTTGAATGTG ATCACTAAATGTTGCTGGCAGTAGAGCTGGAGATGTGCTGTCTCTTTGGTGTCATT AGCACAGAAGCTATTGGAGAAATGATTATTATCTGTTACATAACTTATAGAGCATTTT TCTGCTTCCAATTCCACAAGGTGGAAAGTGCAAGGATGTTTACTTTCTTAACTGTA CTTGCCTTGATTTGATGATGTAAGGTTGTGTGGCAAAAAAAAAAAAA
SEQ ID NO:12	Late	LPS-015	GGTACTCCACTAGACCGGGTAGGGTCTCTCCATGGTTTTGCGACTTAGGTTAGGTG TCCTGTTCTGTAAATGATTTTGAGGTTTTGTAATTGTGAGTATGTTTCCAGGGTTTT GAACCTGGGTACTCGGCCCTTTGTTGGAATGTAGTCTGGTTAATTTATATGTATATGT AACCTTGGGGTTTCGAGCCCAGTTCTCTGTTCTTCTTGAAATGAAATGCGATTTGTT CTAAAAAAAAAAAA

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